Statement of R. Shane Johnson
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Subcommittee on Energy
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Chairman Biggert, Ranking Member Honda, and members of the Committee it is an honor for me to be here today before the House Science Subcommittee on Energy to discuss the Administration's proposed Global Nuclear Energy Partnership or GNEP. GNEP is the nuclear energy component of the President's Advanced Energy Initiative and it addresses the global issues of energy security, the environment, and nuclear proliferation. To support GNEP, the Department has proposed $250 million in fiscal year 2007 to accelerate efforts under the Advanced Fuel Cycle Initiative (AFCI) to demonstrate technologies associated with spent nuclear fuel recycling. My testimony today focuses on the goals, schedule and anticipated costs of the technology development component of GNEP.

As you know, the President has stated a policy goal of promoting a significant expansion of nuclear power here in the United States and around the world. The reasons for this are clear – total world energy demand will double by 2050 and over the next twenty years, electricity demand alone will increase 75 percent over current levels. The safety and performance record of nuclear energy in the U.S. has been outstanding. It is a proven technology that can deliver large quantities of electricity that will be needed in the future, reliably, predictably, affordably and without producing harmful air emissions.

Building on the efforts of the Administration and because of Congress efforts in passing the Energy Policy Act of 2005, we are confident that there will be new plants built in the U.S. over the next 10 years. With more than 130 new nuclear plants under construction, planned or under consideration world-wide, many countries around the world are clearly moving forward with new nuclear plants.

As such, it is important for our own future that nuclear energy expands in a way that is safe and secure, in a way that will not result in nuclear materials or technologies used for non-peaceful purposes. But significant growth will not be possible unless we effectively address the fuel cycle and spent fuel management.

The U.S. operates a once-through fuel cycle, meaning that the fuel is used once and then disposed of without further processing. In the 1970's, the U.S. stopped the old form of reprocessing, principally because it could be used to produce separated quantities of plutonium, a nuclear proliferation concern. But the rest of the nuclear economies – France, Japan, Great Britain, Russia and others operate closed fuel cycles, in which spent fuel is processed and the plutonium and uranium are recovered from the spent fuel to be recycled back through reactors. As a result, the world today has a buildup of nearly 250

metric tons of separated civilian plutonium. The world also has vast amounts of spent fuel and we risk the continued spread of fuel cycle technologies. Furthermore, recent years have seen the unchecked spread of enrichment technology around the world.

Opening Yucca Mountain remains a key priority of the Administration and is a necessity. We are committed to beginning operations at Yucca Mountain as soon as possible so we can begin to fulfill our obligation to dispose of the approximate 55,000 metric tons already generated and approximate 2,000 metric tons being generated annually. Whether we recycle or not we must have Yucca Mountain open as soon as possible. However, the statutory capacity of Yucca Mountain will be oversubscribed by 2010 and without GNEP simply maintaining existing nuclear generating capacity would require additional repositories in the U.S.

GNEP seeks to address the challenges of the expansion of nuclear power and limiting proliferation risk by developing technologies that can recycle the spent nuclear fuel from light water reactors in a more proliferation-resistant manner. In addition, GNEP supports a reordering of the global nuclear enterprise to encourage leasing of fuel from what we call fuel cycle states in a way that presents strong commercial incentives against new states building their own enrichment and reprocessing capabilities. For the U.S., transition to a closed fuel cycle would enable more efficient use of our nuclear fuel resources, would significantly reduce the nuclear waste that requires disposal in a geologic repository and would assure sufficient repository capacity through the end of the century.

To accomplish these objectives, the Department proposes to accelerate the development, demonstration, and deployment of new technologies to recycle spent fuel through the Office of Nuclear Energy's AFCI program. These are technologies that would not result in separated plutonium – a key proliferation concern presented by current generation reprocessing technologies. Moreover, these technologies would be deployed in partnership with other fuel supplier nations. As an initial step, the Department has requested $250 million in FY 2007.

By proceeding with the demonstrations of the separations, fuels and reactor technologies, we will learn the practicality of closing the fuel cycle in the U.S. We have had considerable success demonstrating the advanced separations technology, in particular, at the "laboratory scale." However, by demonstrating a closed fuel cycle at an "engineering scale," will enable us to optimize the design of a full-scale facility and reduce costs and time to deploy a full-scale facility. This will give us the information we need to design and deploy full-scale recycling facilities by the time they are needed decades from now.

The U.S. would propose to work with international partners to conduct an engineering-scale demonstration of advanced separations technologies (*e.g.*, a process called Uranium Extraction Plus or UREX+) that would separate the usable components in used commercial fuel from its waste components, without separating pure plutonium from other transuranic elements.

In addition, the Department would propose to demonstrate the ability to consume transuranic elements separated from the spent nuclear fuel in a fast reactor called the Advanced Burner Test Reactor (ABTR). In conjunction with this, DOE would propose an Advanced Fuel Cycle Facility (AFCF) to fabricate and test the actinide based fuels for the demonstration test reactor.

The Department has established a target of 2011 for initial operation of the advanced separations demonstration facility, 2014 for initial operation of the Advanced Burner Test Reactor using conventional fuels, and 2016 for the first modules of an AFCF. The first mission of the AFCF would be to produce actinide-based fuels for the ABTR.

Early, pre-conceptual estimates of the ten-year cost to bring the engineering scale facilities to the point of initial operation range from $4 billion to $9 billion. As the project matures, we will develop more detailed and accurate baseline of cost and schedule estimates. The experience with the engineering scale demonstrations will inform the design, cost estimates and schedule for building full-scale recycling facilities. More accurate estimates of the demonstration phase will be available as the conceptual and preliminary design phases are completed.

The GNEP technology demonstration program is a phased program. Each phase would begin after a well defined decision on the results of the previous phase and an assessment of the risks associated with proceeding to the next phase. DOE would only proceed to detailed design and construction of these engineering scale demonstrations after the Department is confident that the cost and schedules are understood and after we have put in place the project management framework that will allow these projects to succeed. Presently, the Department's efforts are aimed at conducting the applied research, engineering and environmental studies needed over the next two years to inform a decision in 2008 on whether to proceed to detailed design and construction of the engineering scale demonstration facilities. The $250 million requested in FY 2007 is the Department's best assessment of the funding required for GNEP program technical development priorities and sequencing toward demonstration facilities.

This week, the Department approved the mission need for the demonstration facilities. The Department also issued an advance notice of intent, announcing plans to prepare an environmental impact statement for the GNEP technology demonstration program. The EIS effort is anticipated to be completed over the next two years. Also last month, the Department announced that it is seeking expressions of interest from the public and private sectors for hosting advanced recycling demonstration facilities and related activities. The Department anticipates issuing a Request for Proposals after consideration of the comments received and would anticipate contract awards for site evaluation studies later this year.

In FY 2006 and FY 2007, the Department would continue the applied research to refine the UREX+ technology, begin work on a conceptual design, acquisition strategy, functions and operating requirements and other analyses leading to the development of baseline costs and schedules for the UREX+ demonstration, the advanced burner test

reactor, and the advanced fuel cycle facility by 2008. The Department would also propose to invest $25 million in FY 2007 on the advanced burner reactor technology, to initiate conceptual design studies and a series of extensive studies to establish cost and schedule baselines and determine the scope, safety, and health risks associated with fuel design, siting and acquisition options.

To guide this effort, the Office of Nuclear Energy has instituted a multi-lab process to develop a program plan and a five-year technology plan. The effort involves nine national laboratories. The overall effort also involves several program secretarial offices, including the National Nuclear Security Administration. For example, NNSA will provide key assistance in assuring that safeguards approaches and technologies are incorporated into the demonstration facilities early in the planning for the facilities.

The five-year technology plan will establish the milestones, the work to be accomplished and establish applied research priorities over the next five years, subject to appropriations. The technology plan is anticipated to be completed by the end of May 2006. Execution would extend from the Department down to the multi-lab teams.

In addition, while DOE currently sponsors university research grants through the Nuclear Energy Research Initiative, universities will be engaged through an embedded research and development program. Industry will also be engaged as the program progresses through the design process to provide specific expertise.

Demonstration of the key technologies demands that DOE carry out a variety of research; ranging from technology development for those processes initially identified (equipment, waste forms) to longer-term research and development on alternatives (equipment, processes) for risk reduction. In addition, the Office of Science is initiating a program of basic science in support of nuclear technology with three technical workshops in July 2006. Although not specific to GNEP, the results of this activity will help guide the long-term R&D agenda for closing the fuel cycle.

Furthermore, simulation is expected to play an important role in the development of this program. DOE organized a workshop on simulation for the nuclear industry at Lawrence Livermore National Laboratory which was chaired by Argonne's Lab Director, Dr. Robert Rosner, and Dr. William Martin from the University of Michigan. We expect to see a greater role for simulation as a result, supported by both the Office of Science and the Office of Nuclear Energy.

Systems analysis forms an important part of the ongoing AFCI program and will have an increased role during the next two years. The systems analysis will investigate several key issues. One such issue is the required rate of introduction of burner reactors and separations facilities to avoid a second repository this century. Another would be a detailed study of the technical requirements for the facilities and how they relate to the top level goals of the program. The results of these analyses are essential to establishing the basis for each key decision in the accelerated AFCI program and will have a profound effect on GNEP program planning.

In closing, the U.S. can continue down the same path that we have been on for the last thirty years or we can lead a transformation to a new, safer, and more secure approach to nuclear energy, an approach that brings the benefits of nuclear energy to the world while reducing vulnerabilities from proliferation and nuclear waste. We are in a much stronger position to shape the nuclear future if we are part of it. This is an ambitious plan and the technology demonstrations will be a key challenge for U.S. and our partner nations. But it is an endeavor, which if successful, can ensure that nuclear energy is available, safe and secure for generations to come. We seek the advice and support of this committee and of Congress and I look forward to answering your questions.

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Shane Johnson is the Deputy Director for Technology within DOE's Office of Nuclear Energy. Since 2004, Mr. Johnson as served as Deputy Director for Technology, responsible for the Department's nuclear energy research and support to U.S. nuclear engineering programs. Mr. Johnson served as Acting Director for the Office of Nuclear Energy, Science and Technology between May 2005 and March 2006.

For the last six years, Mr. Johnson has led the Office's nuclear technology initiatives, serving a key leadership role in the initiation and management of all of the Office's major research and development initiatives, including the Generation IV nuclear systems initiative, the Advanced Fuel Cycle Initiative, and the Nuclear Hydrogen Initiative.

Mr. Johnson serves a central role in the Department's efforts to reassert U.S. leadership in nuclear technology development. He is the senior principal in NE responsible for the recently announced Global Nuclear Energy Partnership. He also led the formation of the Generation IV International Forum (GIF), an international collective of ten leading nations and the European Union's *Euratom*, dedicated to developing advanced reactor and fuel cycle technologies. He leads the Office's international cooperation activities, including establishment of cooperative research agreements with other countries and the development by the GIF of the Generation IV technology roadmap, which resulted in the selection of six promising reactor and fuel cycle technologies by the GIF for future development efforts. Mr. Johnson currently serves as the U.S. representative to the GIF policy committee.

Mr. Johnson has over twenty years of relevant management and engineering experience within the Government and industry. During his career with NE, he has had direct management responsibility for all of the NE programs, including nuclear and research facilities. Prior to joining DOE, Mr. Johnson was employed for 5 years by Duke Power Company and Stoner Associates, Inc. where he was responsible for performing engineering studies for nuclear, natural gas, and water utilities.

Mr. Johnson received his B.S. degree in Nuclear Engineering from North Carolina State University and his M.S. degree in Mechanical Engineering from Pennsylvania State University. He is a licensed professional engineer.